MTI (Dendron) Variable Detachable Coils

Preliminary Clinical Experience in Cerebral Aneurysms in Glasgow

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Summary

We present our initial clinical experience of Dendron Variable Detachable System (VDS) coils, now Sapphire VDS from MTI, in the endovascular treatment of cerebral aneurysms. VDS coils, uniquely, can be detached at variable points along their length, allowing placement of as much or as little as desired of the coil within the aneurysm. Our ten patients formed part of a multicentre feasibility study. VDS coils were successfully deployed in all but one aneurysm. The electrolytic detachment mechanism with practice is both simple to use and reliable. The coils are however slightly stiffer than standard coils limiting their use in small aneurysms. This remains a technology in evolution.

Introduction

Following the introduction of the Guglielmi Detachable Coil (GDC) system (Target Therapeutics, Boston Scientific) in 1991 [1,2] endovascular coiling rapidly became an established treatment of cerebral aneurysms. Preliminary results of the International Subarachnoid Aneurysm Trial (ISAT) showing a 24% relative risk reduction in patients treated with coiling [3,4], compared with those undergoing surgical clipping has already, in many countries, led to endovascular coiling being regarded as the first-line treatment for aneurysmal haemorrhage. Platinum coils are now available from several manufacturers with a variety of detachment mechanisms. The Dendron system (Dendron GmbH, Essen, Germany now part of MicroTherapeutics Incorporated (MTI) Irvine, California, USA) uses electrolytic detachment [5]. Long term results of coiling remain uncertain, hence the importance of trials such as ISAT, but dense packing of an aneurysm with coils is considered desirable, and believed to reduce the risks of future recanalisation [6].

The selection of the final coils in an embolisation procedure can sometimes be difficult; if the selected coil proves too long to pack fully into the aneurysm, there is a risk of a tail of coil projecting into the parent artery. Removing a coil at this stage in a procedure can be difficult and even hazardous. MTI Variable Detachment coils (VDS) are the first coils available for clinical use in a trial setting with several detachment points along their length, which may avoid this potential problem. This may improve safety in deploying the last one or two coils in difficult situations. We discuss our initial clinical experience of the MTI VDS coils in our first ten patients.

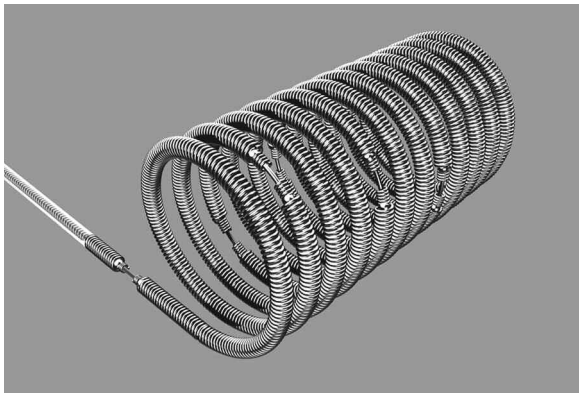

Figure 1 Illustration of a VDS coil. The multiple detachment sites are clearly visible and identical to the proximal detachment site. Note that current coils have only four segments. (Courtesy of Dendron GmbH).

Patients and Methods

Ten consecutive patients presenting with aneurysmal subarachnoid haemorrhage were included. These patients formed part of a multicentre feasibility study for which ethics committee approval was obtained. There were 11 aneurysms in the ten patients (table 1).

At the Institute of Neurological Sciences in Glasgow, we currently use GDC (Boston Scientific), EDC (Dendron, now Sapphire Detachable Coil, MTI) and Detach (Cook) coils in the treatment of cerebral aneurysms. Dendron coils, both EDC and VDS, are compatible with both the other systems and we not uncommonly use coils from several manufacturers in a single aneurysm. In this study, the VDS coil was intended to be the last coil in the procedure. Microcatheters used were Excelsior-14 (Boston Scientific), Rebar-14 or initially Rebar-10 (MTI).

At present VDS coils are available in two sizes only with 3 and 4 mm diameters, both are 12 cm long with four detachable segments, each 3 cm in length. Each detachment site is basically identical to the normal detachment zone on a standard Dendron EDC coil (figure 1).

Results

The VDS coils were successfully deployed in all but one case (table 2). Positioning of the individual coil segments for detachment proved to be simple with good quality fluoroscopy (figure 2).

Patient 1 had two adjacent aneurysms at the basilar tip (figure 3). These were coiled sequentially. In the smaller aneurysm a VDS coil was deployed first (3 cm only). As this proved rather stiff, further segments were not deployed and coiling was completed with GDC SR Soft (Boston Scientific) coils.

In Patient 3 with a small newly ruptured aneurysm we deemed the VDS coil too stiff. It

Table 1 **Patient and aneurysm details**

Patient	Age/ sex	H&H grade	Aneurysm location	Aneurysm size. Fundu s/ neck(mm)
1	35/F	I	Basilar tip	6 / 4
1	35/F	I	Basilar tip	3 / 2
2	40/F	I	ACom	5 / 3
3	66/F	II	PCom	4/3.5
4	70/F	I	Basilar tip	6.4 / 3.8
5	23/F	I	ACom	4.5 / 3
6	49/M	I	PCom	10 / 3
7	46/F	I	ACom	7/3
8	33F	I	Basilar tip	26/7
9	41/F	I	Basilar tip	10/3.5
10	49/F	Unrupt	Basilar tip	20/6.5

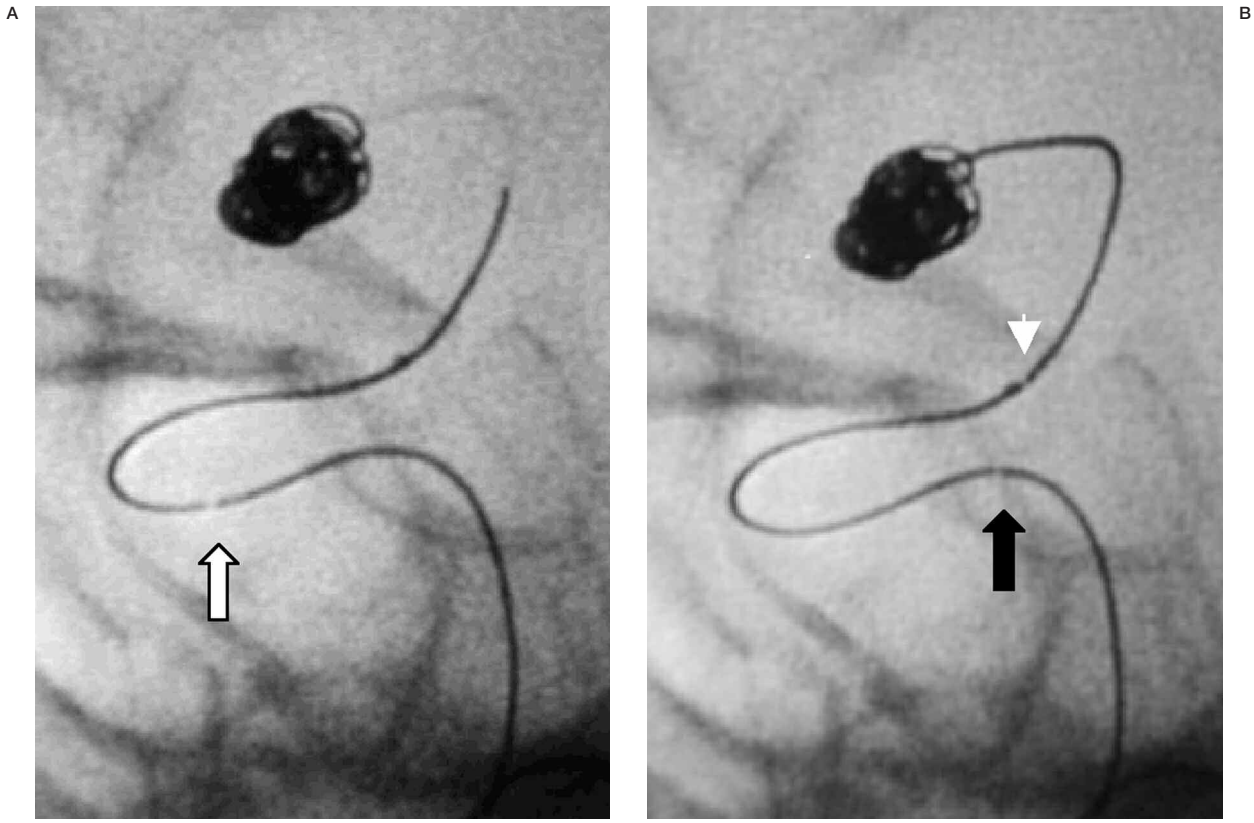

Figure 2 Patient 2. A) The first segment of a VDS coil has passed the proximal marker of an Excelsior catheter. The apparent gap in the coil (white arrow) representing the first detachment point is clearly visible. B) The initial 3 cm of coil is now deployed within the aneurysm. The first detachment point now lies at the tip of the microcatheter within the aneurysm (not visible). The second 3 cm segment lies between the two markers of the catheter, and the second detachment point has been aligned with the proximal catheter marker ready for detachment (white arrowhead). The third detachment point is also visible (black arrow).

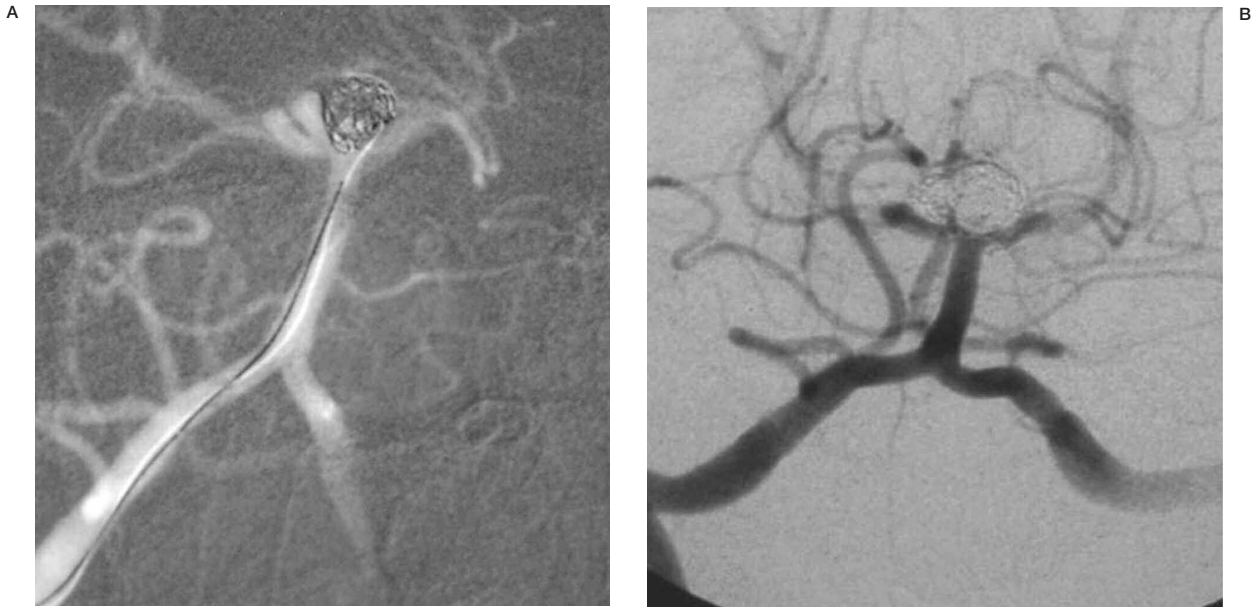

Figure 3 Patient 1. A) The final VDS coil (3 x 12) is about to be introduced into the larger basilar aneurysm. B) Final angiogram after coiling both aneurysms.

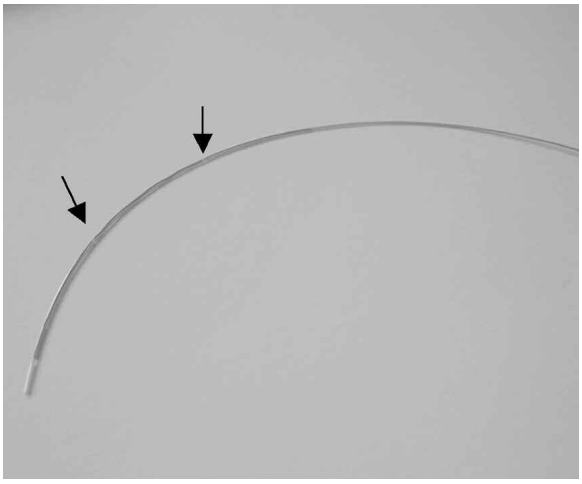

Figure 4 Individual 3 cm coil segments and intervening detachment zones (arrows) are easy to identify within the plastic sheath.

was withdrawn after deploying a single loop. Coiling was completed with GDC SR Soft (Boston Scientific) coils.

In Patient 5, initial coiling of the aneurysm proceeded uneventfully. The last coil chosen was a VDS. After successfully positioning and detaching the third segment of the last VDS coil, the fourth segment separated from the wire inside the microcatheter, during withdrawal of the wire. It withdrew several centimeters before separating. This raised the possibility that it had partially detached by electrolysis within the microcatheter, and then finally separated during withdrawal. Subsequent investigation (see later), however, showed no evidence of electrolysis at this detachment site. Since separation occurred within the microcatheter and we had already decided that this was to be the last coil, the microcatheter was simply withdrawn from the aneurysm as normal and there were no clinical sequelae. According to Dendron, this was the first time detachment has occurred within a microcatheter. In spite of this technical complication, no clinical complications were encountered in this series and all patients made good recoveries (Glasgow Outcome Scale).

Discussion

Dendron electrolytically detachable coils are now widely used for treating cerebral aneurysms. A growing range of different coil shapes including helix, straight, J-shaped, and three-dimensional are available from a number of companies including Boston Scientific, Cook, Cordis, Micrus as well as Dendron (MTI). All these coil types whether their detachment mechanism be electrical, mechanical or hydrostatic, have a single detachment point between the coil itself and the straight pusher-wire. VDS coils are unique in possessing multiple detachment points. The desirability of having a coil that can be detached at any desired point along its length has long been recognized. This has yet to be realized commercially, but the VDS system appears to offer at least a partial solution and is likely to lead to further refinements.

In clinical use, the behaviour of the VDS coils will be familiar to any neurointerventionist familiar with the treatment of aneurysms. Aligning the detachment points is not difficult if good quality fluoroscopy equipment is available (if it is not available, endovascular procedures of any sort would be hazardous). The detachment zones appear stiffer than the rest of the coil and the whole coil thus appears stiffer than a standard coil. For this reason, we now prefer not to use VDS as the first or only coil in a small aneurysm. In addition we have found a marked increase in friction when trying to pass VDS coils through a size-10 microcatheter, although we have performed two early procedures successfully with Rebar-10 microcatheters (MTI). We now only use size-14 or larger catheters (Excelsior or Rebar-14). Newer size-10 microcatheters such as the SL-10 (Boston Scientific) with thinner braided walls and larger internal lumens, however, appear compatible. As noted above, detachment of a coil segment occurred within the microcatheter in patient 5 during withdrawal. Separation of the coil was readily detected by a change in the ease of movement of the pusher-wire and the last unintentionally detached segment was readily visible close to the catheter tip near the skull base. Although there were no clinical sequelae, if the separation had occurred more proximally, in the cervical carotid artery, it would not have been visible. Attempts at placing a further coil could then have been hazardous as a new coil could push the already detached segment into the aneurysm/parent vessel. If there is any doubt, it is simple to scrutinize the remaining segments attached to the

coil wire after withdrawal to confirm the correct number are present. With proper illumination it is easier to see and count the coil segments attached to the wire after retrieval into the plastic sheath (figure 4), rather than hanging in midair.

According to Dendron, among the first 60 patients treated with VDS, this was the only reported occurrence of detachment within the catheter. Microscopy of the detachment zone of the segment and pusher wire shows that there was no electrolysis at this point (figure 5).

The sharp separation indicates mechanical detachment of the segment, most likely related to the 'tight fit' of the coil within the Rebar-10 microcatheter and the perceived friction during coil manipulation during the procedure. Occasional unintentional detachment of GDC and other coils because of excessive manipulation, stretching, friction, etc. is well recognized and the VDS detachment principle thus remains valid.

VDS coils are likely to be cost effective. Not infrequently for example, two 3 x 4 or 3 x 6 coils may be used because of uncertainty as to whether a longer coil could be deployed within the aneurysm. As much or little as desired of a

Figure 5 Detachment zone of the recovered coil segment in patient 5. Note absence of electrolysis and the sharply defined wire. Electrolysis would have dissolved and thinned the metal.

Table 2 **Details of VDS coil procedures**

Patient	Aneurysm location	Fundus/ neck (mm)	No. of coils Total/VDS	VDS coil (segments)	VDS detach time	% Occlusion	Outcome (GOS)
1	Basilar tip	6 / 4	5 / 2 3-12(3) 39sec	4-12(1), 90sec >99%	Good		
1	Basilar tip	3 / 2	3/1	4-12(1)	34sec	> 99%	Good
2	ACom	5 / 3	5/1	4-12(2)	65sec	> 99%	Good
3	PCom	4/3.5	4/0	*	*	95-99%	Good
4	Basilar tip	6.4 / 3.8	5/1	4-12(1)	62sec	95-99%	Good
5	ACom	4.5 / 3	4/1	4-12(3)**	42sec	95-99%	Good
6	PCom	10 / 3	9/1	3-12(3)	45sec	> 99%	Good
7	ACom	7/3	5/1	4-12(3)	103sec	95-99%	Good
8	Basilar tip	26/7	6/1	4-12(4)	40sec	90%	Good
9	Basilar tip	10/3.5	5/2	3-12(7)	35s/42s	> 99%	Good
10	Basilar tip	20/6.5	7/1	4-12(2)	87s	90%	Good

*Patient 10 is a recoiling of an unruptured aneurysm; *VDS coil withdrawn from aneurysm; **VDS detachment malfunction.*

VDS coil can be deployed, or alternatively, one segment may be detached, followed by another each treated as a separate coil. When treating multiple aneurysms at a single session, undetached segments of a VDS could in theory be used in subsequent aneurysms, which would greatly increase their cost effectiveness. This is, however, not currently recommended by the company.

In our experience, VDS coils are an interesting and unique addition to the range of available coils. In our centre, the current role of VDS coils would be as the last or penultimate coil in aneurysms of 4 mm diameter or greater. We believe this is a technology in evolution and many potential improvements could be envisioned. The development of soft coils and smaller coils with shorter segments, for example, will be important for the future success of this technology.

Acknowledgments

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